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CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 7 January 2003 with an application for Letters Patent number 523504 made by KEITH RANDAL ANDERSON; JILLYAN OLIVE PETERSON.

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Dated 17 February 2004.

Neville Harris

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523504

NEW ZEALAND PATENTS ACT 1953

PROVISIONAL SPECIFICATION

AN AERIAL CABLEWAY TRANSPORT SYSTEM OR RIDE

We, KEITH RANDAL ANDERSON and JILLYAN OLIVE PETERSON, New Zealand citizens of 194 Cable Road, RD 1, Nelson, do hereby declare this invention to be described in the following statement:

FIELD OF THE INVENTION

The present invention relates to an aerial cableway transport system for passengers. In particular, although not exclusively, the invention may be employed for recreational purposes to provide a passenger amusement or adventure ride.

BACKGROUND TO THE INVENTION

There are various aerial cableway systems for transporting passengers and/or goods along long mountain terrains, over canyons and rivers, and through other areas where no runways, railways or similar structures can or may be constructed.

These cableway systems generally comprise an aerial track suspended between two or more stationary towers or stations, and one or more vehicles, such as carriages, cabs, or cars, which travel along the track. The aerial track is generally a self-contained traction cable, which is driven by pulleys or bull wheels arranged in the end towers or stations. The driven traction cable moves the vehicles between the towers and stations. The vehicles may be uncoupled from the traction cable at the end towers or stations and moved through the stations or towers at a slow speed so that passengers can enter or leave them, or so that goods can be loaded and unloaded. Typically, the vehicles are suspended from the traction cable by various permanently attached or detachable suspension members, such as hangers, grips and the like.

Common passenger cableway transport systems, such as gondola-lift and chair-lift systems, generally utilise a cableway of the endless mono-cable type, whereby the detachment of the gondola or chair to the continuously moving traction cable is executed during the entrance of the gondola or chair into the end towers or stations and the carriage runs on transfer rails towards the exit of the station to be coupled to the cable in a manner well known in the art.

Recreational, adventure, and amusement rides utilising aerial cableway systems, such as flying foxes, are known. Typically, these rides depend for popularity upon a lengthy

duration of brisk acceleration which quite often involves moving a passenger through bends and the like.

It is an object of the present invention to provide an aerial cableway transport system which provides the public with a useful alternative.

SUMMARY OF THE INVENTION

In a first aspect, the present invention broadly consists in an aerial cableway transport system for passengers including a rotatable endless loop cable spanning between two or more stations, a drive system operable to rotate the loop cable, a passenger carrier attachable to the loop cable which can accommodate one or more passengers, and a suspension member which attaches the passenger carrier to the loop cable, where the suspension member includes a roller mechanism to enable the passenger carrier to free-roll along the loop cable and a clamping mechanism which can be actuated to alternatively fix the passenger carrier to the loop cable.

Preferably, the clamping mechanism is remotely actuated. More preferably, the clamping mechanism is remotely actuated via a radio link or the like. More preferably, the clamping mechanism can be remotely actuated via a radio link or manually actuated by a control on or in the passenger carrier.

Preferably, the drive system includes a bull wheel arrangement in each of the stations. More preferably, one or more of the bull wheels is rotated by one or more gear drive mechanisms situated in one or more of the stations. More preferably, the gear drive mechanisms can rotate the bull wheels, and ultimately the loop cable, clockwise or anticlockwise.

Preferably the drive system includes a loop cable tensioning mechanism adapted to the bull wheels which enables the slack and arc of the loop cable to be adjusted between each station. More preferably, the tensioning mechanism is powered by hydraulics.

Preferably, the suspension member includes a swivel mechanism to enable the entire passenger carrier to rotate 360°. More preferably, the swivel mechanism can be actuated either remotely via radio link, or manually by a control on or in the passenger carrier.

Preferably, the aerial transport system includes two stations which form anchor towers. More preferably, one anchor tower is designated as the loading/drive tower and the other the return tower. Preferably, the anchor towers are cast into rock or similar matter for support. More preferably, the two anchor towers are more than 1km apart.

Preferably, the aerial transport system includes a control system. More preferably, the control system is electronic and/or computer based. More preferably, the control system is located in one of the stations. More preferably, the control system can control the suspension member's clamping and swivel mechanisms, and the bull wheel gear drive and tensioning mechanism(s).

Preferably, the control system includes an accident avoidance control system including proximity sensors situated on the stations and passenger carriers. More preferably, the proximity sensors communicate within the accident avoidance control system via radio link. More preferably, in the event of possible collision of passenger carriers the accident avoidance control system is operable to control the suspension member's clamping and swivel mechanisms, and the bull wheel gear drive and tensioning mechanism(s) appropriately to avoid collision.

Preferably, one or more passenger carriers can operate on the loop cable at one time.

In a second aspect, the present invention broadly consists in an aerial cableway transport system for goods including a rotatable endless loop cable spanning between two or more stations, a drive system operable to rotate the loop cable, a goods carrier attachable to the loop cable which can accommodate a load of goods, and a suspension member which attaches the goods carrier to the loop cable, where the suspension member includes a roller mechanism to enable the goods carrier to free-roll along the

loop cable and a clamping mechanism which can be actuated to alternatively fix the goods carrier to the loop cable.

The second aspect may have any one or more features outlined in respect of the first aspect above.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

The invention consists in the foregoing and also envisages constructions of which the following gives examples only.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention is described with reference to the drawings and by way of example only, wherein:

Figure 1a is a perspective view of the preferred embodiment aerial cableway transport system,

Figure 1b is a side elevation view of the arc profile of a loaded and unloaded loop cable of the preferred embodiment aerial cableway transport system,

Figure 2a is a side elevation view of a passenger carrier attached to the loop cable by a suspension member,

Figure 2b is a side elevation view of the passenger carrier loaded with passengers and attached to the loop cable,

Figure 2c is a front elevation view from direction 25 of Figure 2b of the passenger carrier loaded with passengers and attached to the loop cable,

Figure 3 is a portion of the hydraulic circuit diagram of the preferred hydraulic system which actuates a loop cable clamping mechanism,

Figure 4a is a plan view of a portion of a loading/drive tower of the aerial cableway transport system,

Figure 4b is a side elevation view from direction 45 of Figure 4a of the loading/drive tower,

Figure 4c is a front elevation view from direction 46 of Figure 4b of the loading/drive tower,

Figure 5a is a plan view of a portion of a returning tower of the preferred aerial cableway transport system,

Figure 5b is a side elevation view from direction 55 of Figure 5a of the returning tower.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1a shows a preferred embodiment of the aerial cableway transport system 1 used to provide an adventure or recreational ride for one or more passengers across a scenic valley or gorge.

The cableway system 1 includes a rotatable endless loop cable 15 suspended across a valley between two stations 11, 12. The cableway system 1 includes a passenger carrier 13 which transports one or more passengers back and forth across the valley as it rides on the loop cable 15. The passenger carrier 13 is attached to the loop cable 15 by a

suspension member 14, which includes roller and clamping mechanisms to be explained in more detail below.

The passenger carrier 13 can free-roll along the loop cable 15 under the influence of gravity via the suspension member's 14 roller mechanism, and can be retrieved to either station 11 or 12 by actuation of the suspension member's 14 clamping mechanism and rotation of the loop cable 15 in the appropriate direction.

In the preferred embodiment, the stations 11, 12 form anchor towers which are built into rock 101 or similar matter for support. One station is the loading/drive tower 11, which facilitates the loading of passengers and drives the rotation of the loop cable 15, while the other is the return tower 12. Typically, the loading/drive tower 11 is provided with a canopy 10 to shelter people and equipment from the weather.

The loop cable 15 is supported and rotated by a drive system 18, 19 consisting of a bull wheel and gear drive mechanism. The loop cable 15 is supported between bull wheels 16, 17, in the loading/drive 11 and return 12 towers respectively. Bull wheel 16 is driven by a gear drive mechanism (not shown), which enables the loop cable 15 to be rotated either clockwise or anticlockwise.

Figure 1b shows the arc of the loop cable when unloaded 15a and loaded 15b as it is suspended across a valley between the two anchor towers 11, 12. The arc of the loop cable 15 enables the passenger carrier 13 to roll back and forth across the cable 15 under the influence of gravity. The two anchor towers 11, 12 shown are almost level in height, although it will be appreciated that this is not a requirement and one anchor tower could be higher than the other.

The drive system 18, 19, includes a loop cable 15 tensioning mechanism, for example powered by hydraulics or the like, which is adapted to move one or more of the bull wheels radially either towards or away from the other to enable the slack and ultimately the arc of the loop cable 15 to be adjusted according to the various operational and safety requirements of the cableway system 1. For example, the arc of the loop cable 15

may be adjusted in accordance with the load of the passenger carrier 13, wind, or expansion and contraction cable weather characteristics.

The cableway system 1 may be adapted to provide a number of possible adventure or recreational rides for passengers ranging from a fast adrenaline ride to a slower scenic ride.

In an adrenaline ride for example, passengers are loaded onto the passenger carrier 13 at the loading/drive tower 11. At the start of the ride the loaded passenger carrier 13 is released from the loading/drive tower 11 to free-roll along the loop cable 15, accelerating under the influence of gravity, toward the return tower 12. Wind resistance, equipment friction, and the loop cable 15 arc will slow the passenger carrier 13 to a halt before it runs all the way across to the return tower 12, at which point the passenger carrier 13 can be fixed to the loop cable 15 by actuation of the suspension member's clamping mechanism. The gear drive mechanism, located in the loading/drive tower 11, is then activated to rotate the loop cable 15 to facilitate moving the passenger carrier 13 closer toward the return tower 12. Once the passenger carrier 13 is in position at the return tower 12, the clamping mechanism is released, this time allowing the passenger carrier 13 to free-roll on the loop cable 15, under the influence of gravity, back toward the loading/drive tower 11. This process may continue a number of times to provide the passengers with a number of gravity cable rides. At the end of the ride the clamping mechanism is actuated and the loop cable 15 rotated to return the passenger carrier 13 to the loading/drive tower 11 for unloading of passengers.

In an alternative adrenaline ride, the passenger carrier 13 once loaded is released from the loading/drive tower 11, and allowed to oscillate back and forth between the two towers 11, 12, without actuation of the clamping mechanism. At the end of the ride when the passenger carrier 13 comes to a rest, or otherwise, substantially in the middle of the cable, the clamping mechanism is actuated and the loop cable 15 rotated to return the passenger carrier 13 to the loading/drive tower 11 for unloading of passengers.

For a slower scenic ride, the cableway system can be adapted to provide a ride back and forth between the two towers 11, 12. For this ride, a loaded passenger carrier 13 is clamped to the loop cable 15, via the clamping mechanism, for the entire duration of the ride. The loaded passenger carrier 13 is transported from the loading/drive tower 11 and across to the return tower 12 via activation of the gear drive mechanism, which rotates the loop cable 15 and attached carrier 13 in the appropriate direction. Once the passenger carrier 13 reaches the return tower, the gear drive can be driven in reverse, thereby rotating the loop cable 15 so as to return the passenger carrier 13 to the loading/drive tower 11 for unloading of passengers.

Partial or controlled actuation of the clamping mechanism can be utilised to provide a ride, which is a compromise between the full adrenaline gravity ride and the slower scenic ride, in terms of speed. Alternative methods of providing various rides can be derived using the cableway system 1 and are included within the scope of the invention. It will be appreciated that the return tower 12 can be adapted to provide passenger loading and unloading capability if desired.

The cableway system may include an electronic and/or computer based control system or the like (not shown). Typically the control system controls the operation of drive system's 18, 19 gear drive and tensioning mechanism(s), and the passenger carrier's clamping mechanism, in accordance with the ride being provided. The control system may be located in the loading/drive tower 11 and thereby hardwired to the drive system 18. The control system may actuate the passenger carrier's 13 clamping mechanism remotely via radio link. It will be appreciated that the control system can be located in the return tower 12, or in a remote location distinct from either tower 11, 12.

Referring to Figures 2a – 2c, the passenger carrier 13 includes a base framework 27, which one or more passenger seats 28 are mounted to or integrally formed within. The passenger seats 28 include safety harnesses 29 to secure passengers in their seats. The passenger carrier 13 is attached to or integrally formed with the suspension member 14, which is attachable to the loop cable 15. The suspension member 14 includes a support member 26 to which a roller mechanism arrangement 20 is attached or integrally

formed to enable the passenger carrier 13 to free-roll on the loop cable 15. A clamping mechanism 21 is also attached to or integrally formed with the support member 26, which can be actuated to fix the passenger carrier 13 to the loop cable 15.

As mentioned, the clamping mechanism 21 may be actuated remotely via a radio link between the control system in the loading/drive tower 11 and a control box 22 on or in the passenger carrier 13. The control box 22 is operable in response to a radio signal received from the control system to actuate or release the clamping mechanism 21. The control box 22 includes a radio receiver/transmitter, battery power supply, and other electronic control circuitry. For safety, the passenger carrier 13 may be equipped with a switch, button, or handle (not shown) to enable manual actuation of the clamping mechanism 21 by a passenger in the passenger carrier 13.

The suspension member 14 also includes a pivoting arrangement between the support member 26 and the roller mechanism 20, which allows the passenger carrier 13 to pivot about points 24, 24a and 24b, at the front, and point 23, at the rear, to account for the arc of the loop cable 15.

Referring to Figure 3, the clamping mechanism 21 may be actuated by a hydraulic system 37 on or in the passenger carrier 13, which is in turn activated by the carrier's 13 control box 22. The control box 22 may be configured to send control signals to actuate a DC powered linear ball screw 30, which is coupled to the ram 35 of a master cylinder 34 of the hydraulic system 37, such that rotation of the ball screw causes movement of the ram 35. Fluid chamber A of the master cylinder 34 is in fluid contact with chambers C of two secondary cylinders 31 via hydraulic pipe lines 33 or similar. Fluid chamber B of the master cylinder 34 is in fluid contact with chambers D of the two secondary cylinders 31 via hydraulic pipe lines 32 or similar.

When the clamping mechanism 21 is to be actuated, the control box 22 sends a signal to the DC linear ball screw which moves the master cylinder's 34 ram 35 into the cylinder 34, thereby forcing fluid from chamber B to flow into chambers D. This in turn forces the secondary cylinder's 31 rams 36 to move out of their cylinders 31 to actuate the

clamping mechanism 21 to clamp onto the loop cable 15 and to prevent relative movement between the passenger carrier 13 and the loop cable 15. To unclamp the clamping mechanism 21, the control box 22 sends a signal to the DC linear ball screw which moves the ram 35 out of the master cylinder 34. This forces the fluid in chamber A to flow into chambers C of the secondary cylinders 31, which forces the rams 36 to withdraw back into the cylinders 31, thereby deactivating the clamping mechanism 21. It will be appreciated that other forms of clamp actuation, for example electrical, could be used.

The suspension member 14 of the passenger carrier 13 may be adapted to include a swivel mechanism (not shown) to enable the passenger carrier 13 to rotate about a suitable angle. This swivel mechanism may also be controlled remotely, for example by the control system, via the control box 22 on the passenger carrier 13. Manual actuation and control of the swivel mechanism may be provided for passengers in the form of a switch, dial, button, knob or the like. It may be desirable for the passenger carrier to be rotatable about an angle of about 180°, so that the passenger carrier 13 can face in the direction of travel, i.e. the passenger carrier 13 may be rotated 180° once the first free-roll ride toward the return tower 12 is complete, ready for a second ride back toward and facing the loading/drive tower 11. More preferably, the passenger carrier 13 is rotatable 360°.

The control system may include an accident avoidance control system comprising proximity sensors, which communicate via radio link or the like, situated on the passenger carriers 13 and towers 11, 12. The accident avoidance control system may have control over one or more of the cableway system's 1 features, including the clamping mechanism 21, swivel mechanism, and the bull wheel gear drive and tensioning mechanism(s). In the event of possible collision or emergency, the accident avoidance control system can co-ordinate these various mechanisms to help prevent an accident while passengers are riding on the cableway system 1.

Referring to Figures 4a – 4c, a suitable drive system 19 for the loading/drive tower 11 is shown. The loop cable 15 is looped around bull wheel 16, which is rotated by a gear

drive mechanism (not shown). The drive system 19 includes a hydraulic tensioning mechanism 40, which can move the bull wheel 16, for example, laterally between points E and F. As mentioned, this enables the slack, and ultimately the arc of the loop cable 15 to be adjusted in accordance with various operating and weather factors.

Referring to Figures 5a and 5c, a suitable drive system 18 for the return tower 12 is shown. The loop cable 15 is looped around bull wheel 17, which may or may not be rotated by a gear drive mechanism. The drive system 18 may also include a tensioning mechanism 50, which is configured to move the bull wheel 17 laterally as shown by arrow G to adjust the slack and arc of the loop cable 15. It will be appreciated that the tension could be adjusted by movement of only either bull wheel 16 or 17 in a single tower.

The cableway system 1 can be adapted to accommodate two passenger carriers 13 operating simultaneously on opposite sides of the endless loop cable 15. Loading and unloading capability at the returning tower 12 would be enabled to allow for this. The passenger carrier's 13 loading capacity can be adapted to accommodate for this alternative arrangement also. For example, one 4-person passenger carrier 13 could operate solely, or two 2-person passenger carriers 13 simultaneously. Larger or smaller passenger carriers could be used if desired. The passenger carriers may also be fully enclosed.

In a particularly preferred embodiment, the two towers 11, 12 are spaced approximately 1.6km apart and are almost level in height. The arc of the loop cable 15, which spans the 1.6km gap, would have a deflection drop of approximately 150m, providing for a possible passenger carrier 13 speed of 100 km/hour. The loop cable 15 takes up a shape which limits the cable tension under operating loads to approximately 0.222 times the ultimate strength of the loop cable 15, to provide for a factor of safety of approximately 4.5. The towers 11, 12 and the bull wheels 16, 17 and gear drive mechanism(s) will sustain loads such as 13 tonne per cable length and a 26 tonne load of the bull wheels 16, 17 and foundations. The loop cable 15 tensions are typically maintained at 13 tonne maximum with the bull wheels being radially moveable by up to about 5 meters via the

hydraulic tensioning mechanism(s) 40, 50. This allows the loop cable 15 to take up a shape consistent with the 13 tonne load and the passenger carrier 13 load, which is typically in the range of 1 tonne.

It will be appreciated that the cableway system 1 is scalable, so can be expanded or contracted to suit requirements. The addition of further stations, bull wheels, and gear drive mechanisms is included within the scope of the invention. The loop cable 15 length may be altered according to requirements. It is not necessary that the stations be at the same height.

It will be appreciated that the cableway system 1 can be adapted for the transportation of heavy goods, such as tree-trunks, building material or the like in various locations, and would be provided with a goods carrier for this purpose.

The foregoing description of the invention includes preferred forms thereof. Modifications and alternatives as would be obvious to those skilled in the art are intended to be incorporated in the scope hereof.

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Figure 1a

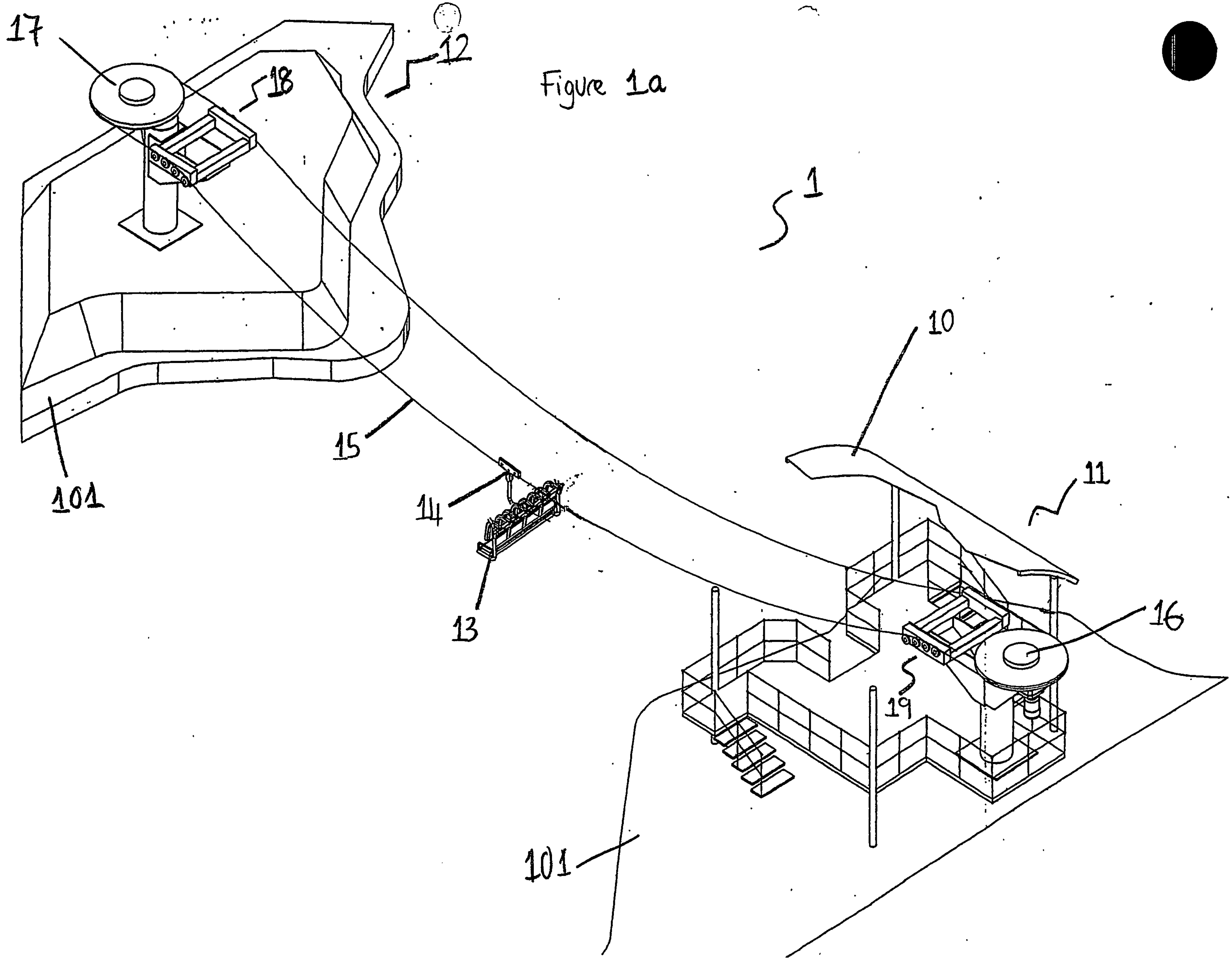
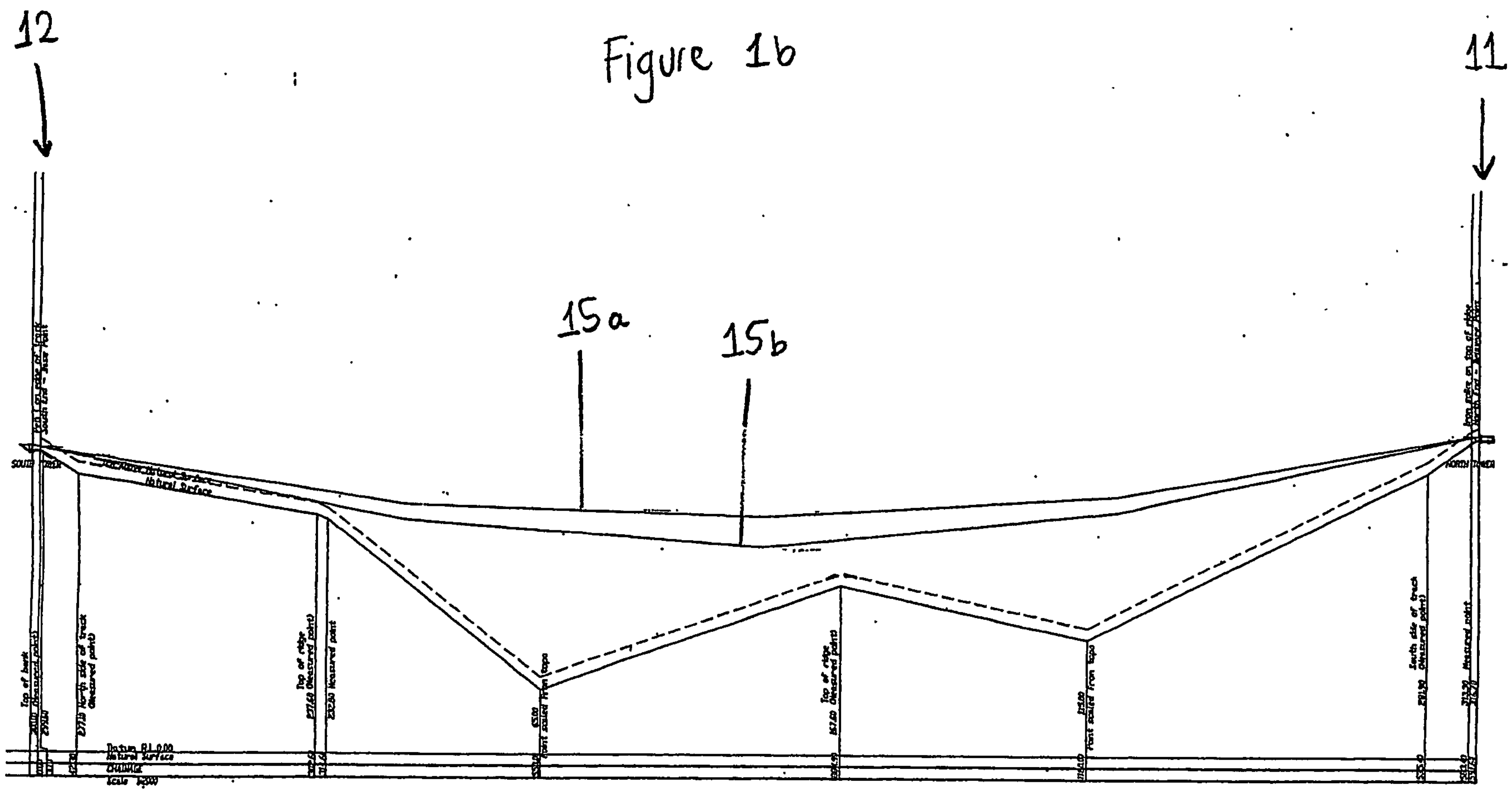
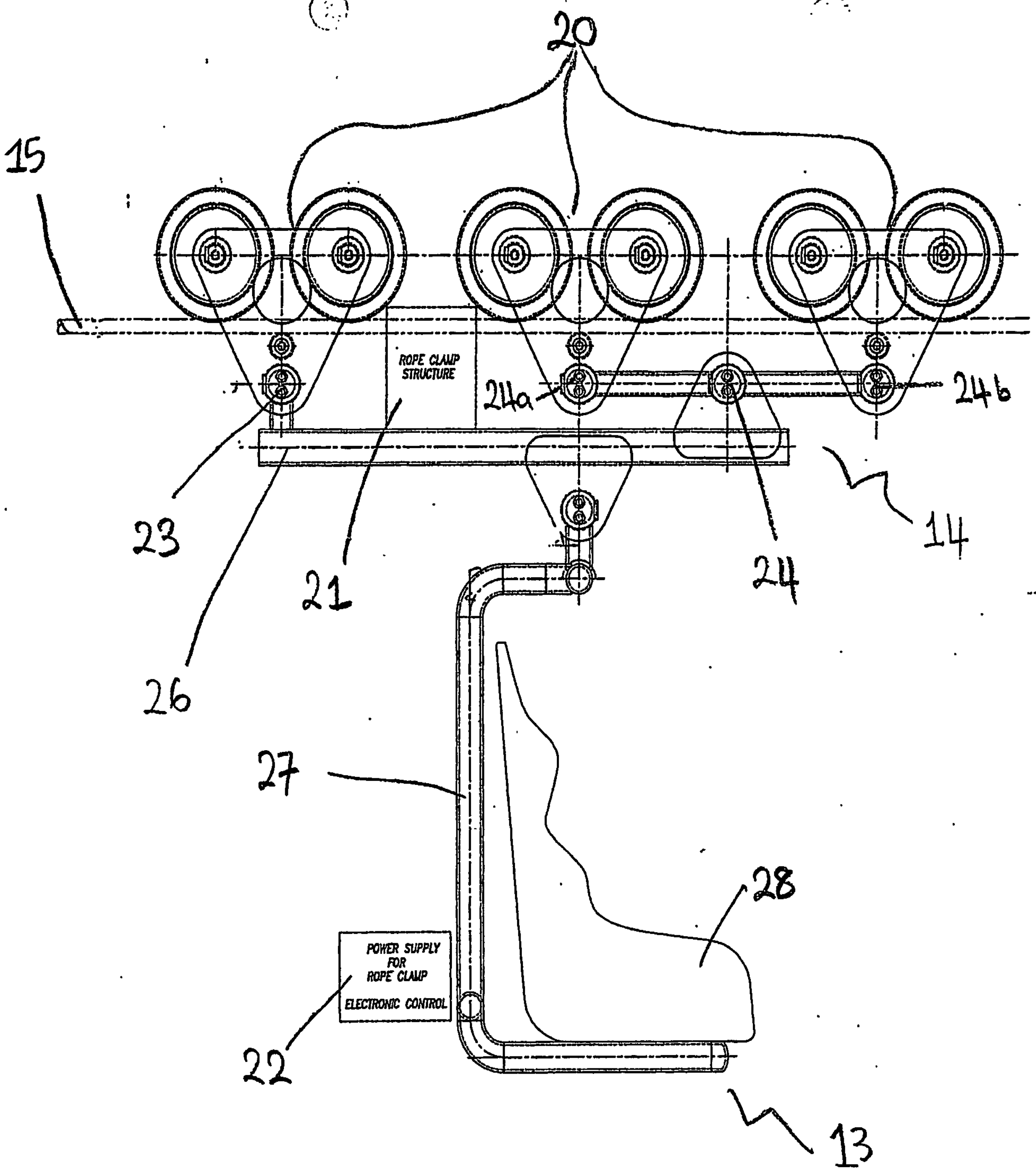


Figure 1b



Typical Survey Cross Section



20
15
ROPE CLAMP STRUCTURE
24a
24b
23
21
24
14
26
27
28
POWER SUPPLY FOR ROPE CLAMP
ELECTRONIC CONTROL
22
13

Figure 2a:

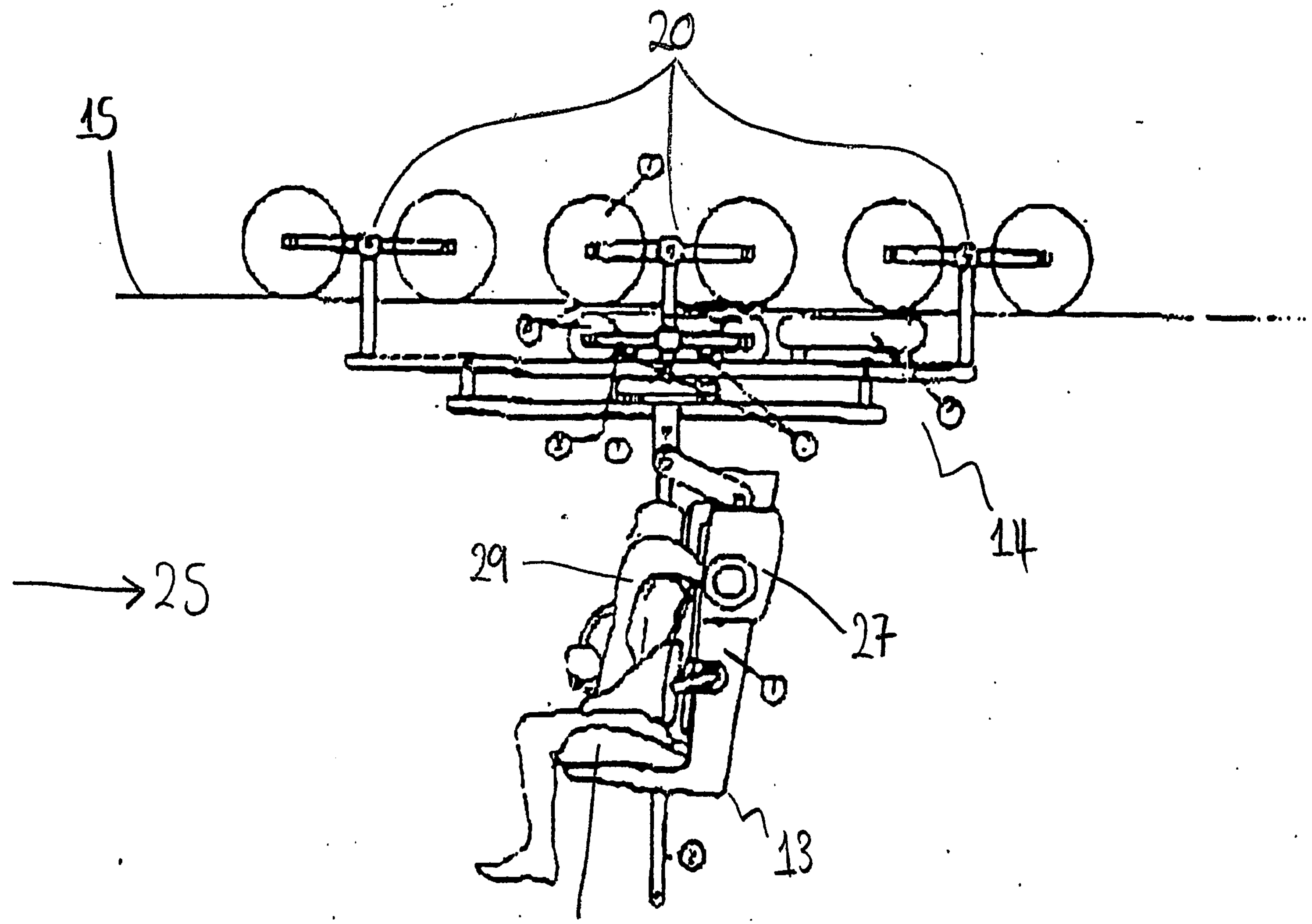


Figure 2b:

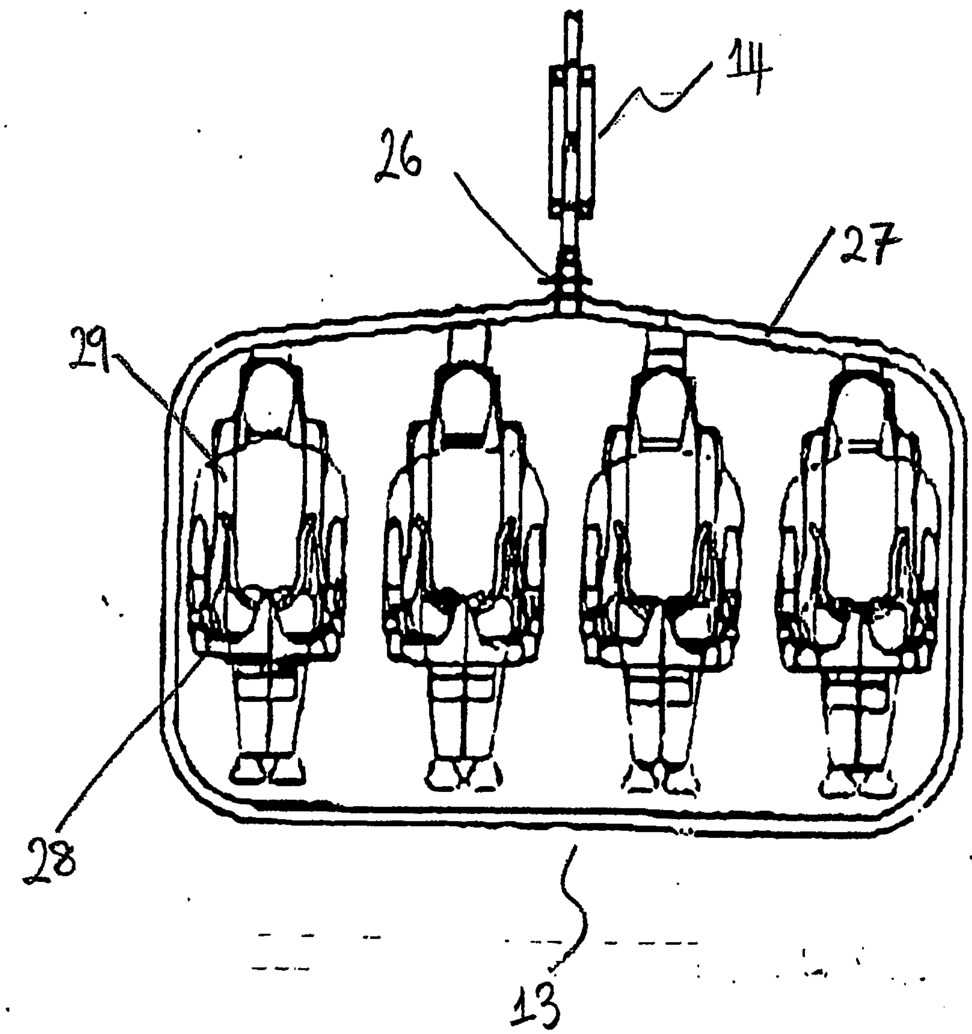
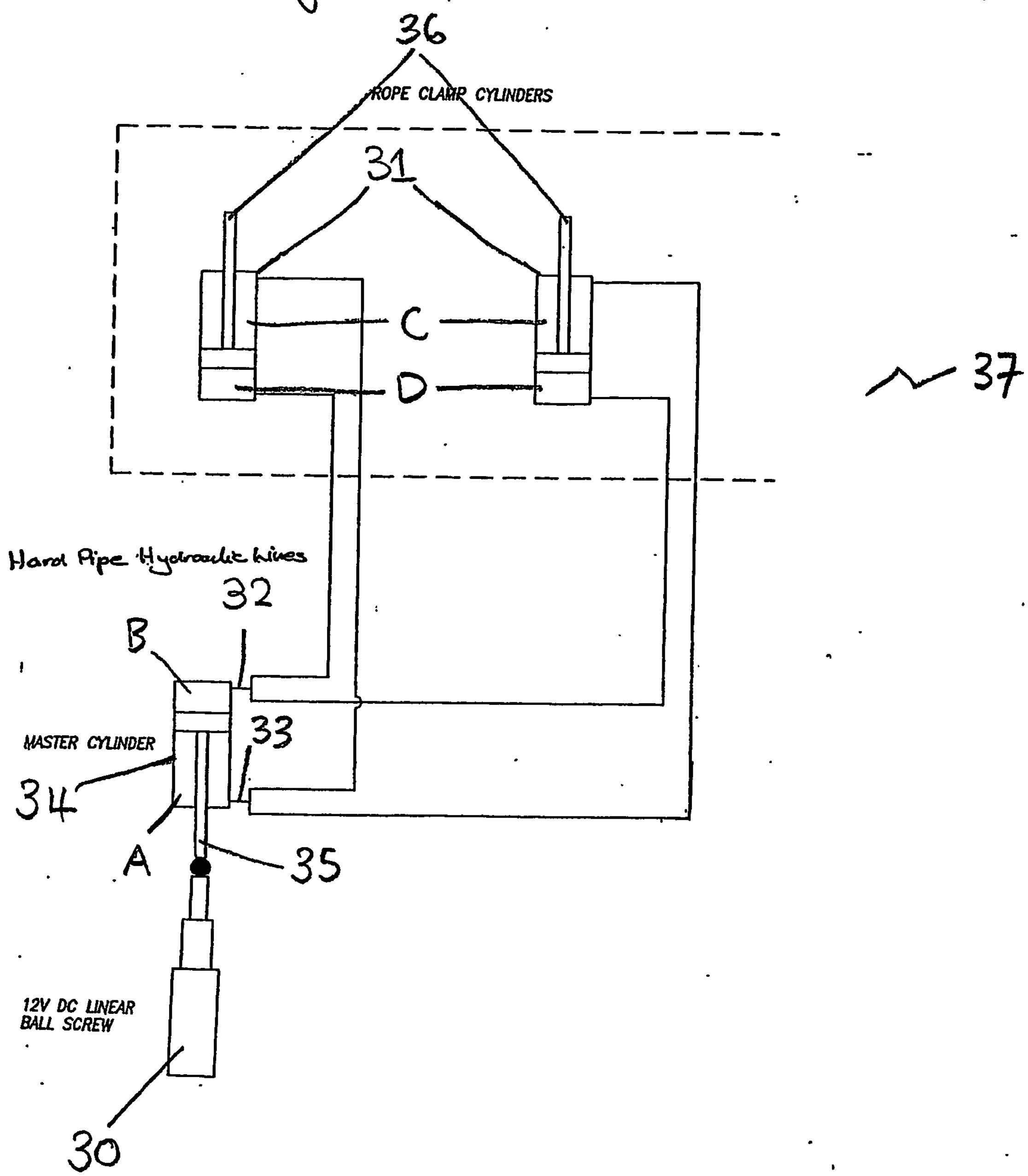


Figure 2c:

Figure 3


36
ROPE CLAMP CYLINDERS
31
C
D
37
Hard Pipe Hydraulic Lines
32
B
33
MASTER CYLINDER
34
A
35
12V DC LINEAR
BALL SCREW
30

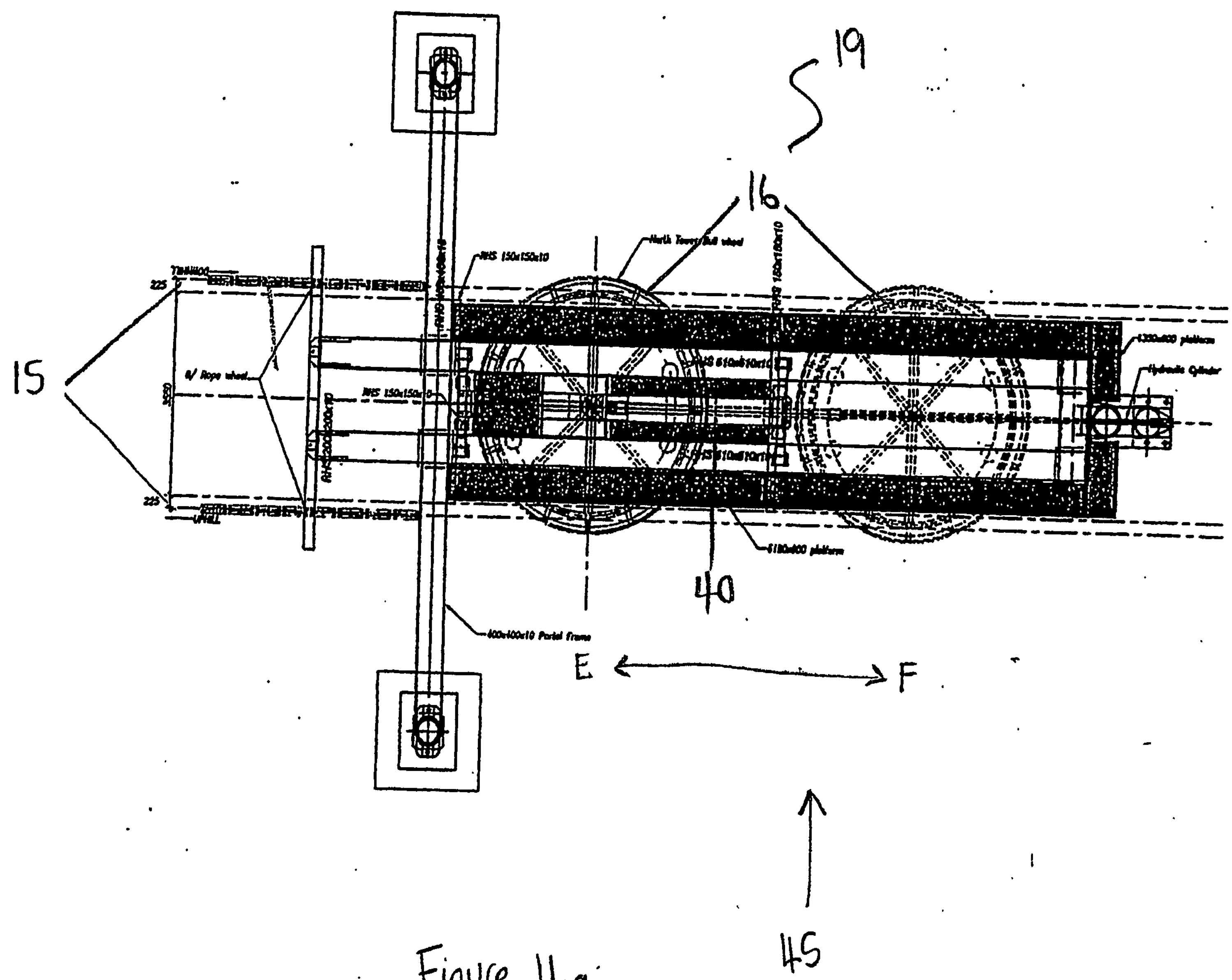


Figure 4a.

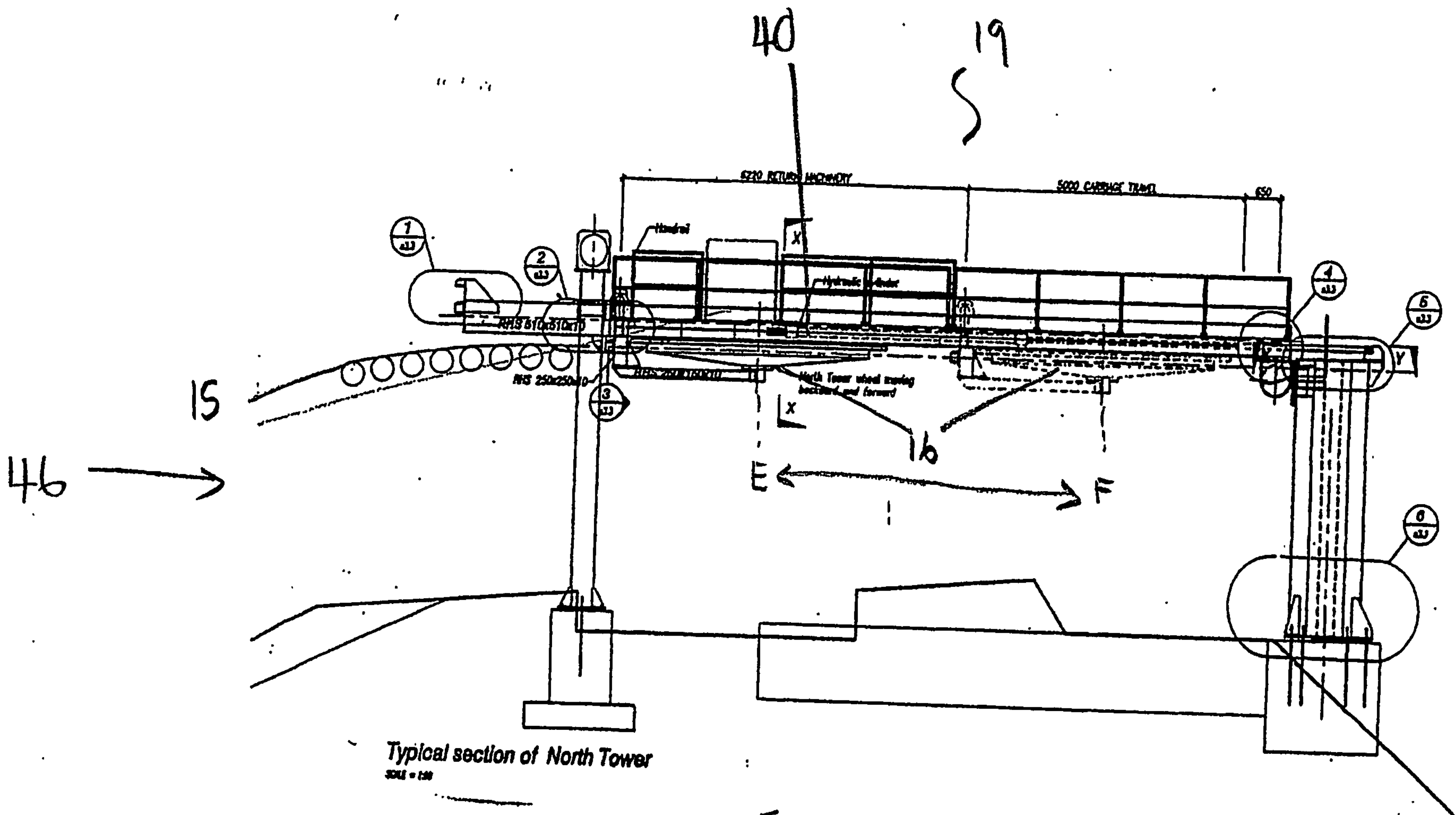
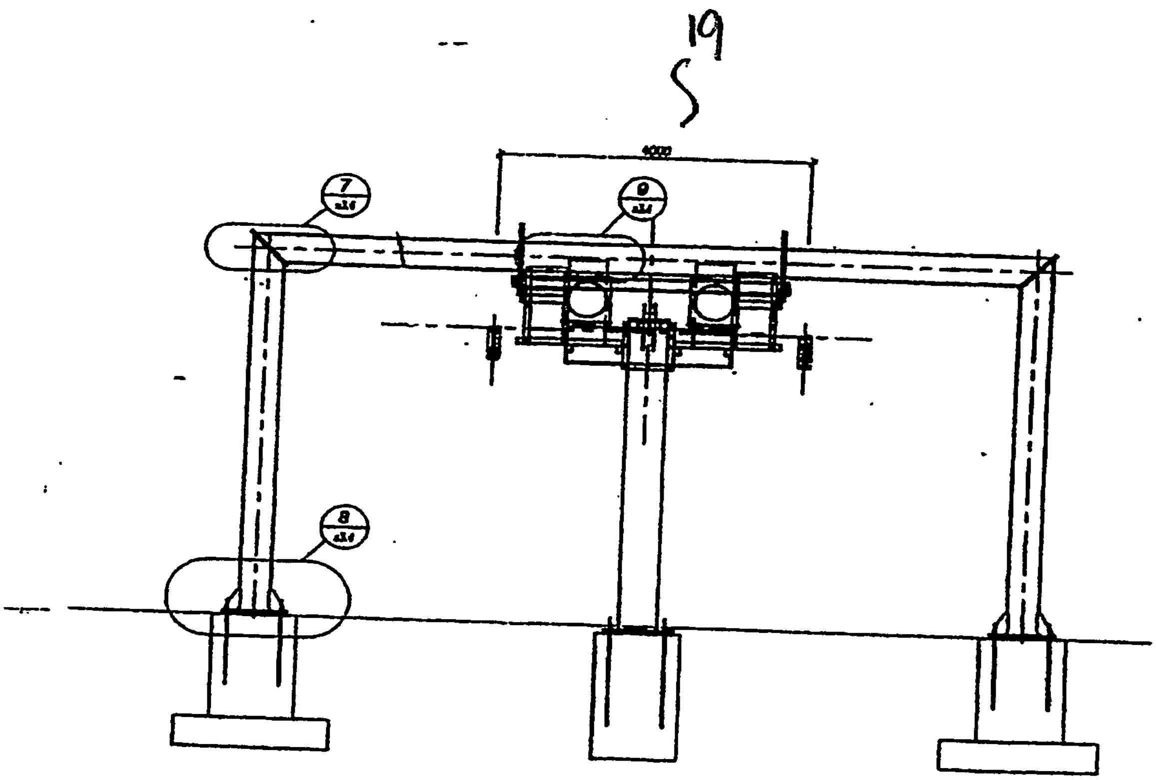

40
19
5220 RETURN MACHINERY
5000 CARRIAGE TRAVEL
650
Handrail
Hydraulic Cylinder
X
RHS 510x510x10
RHS 250x250x10
North Tower wheel moving backward and forward
16
E
F
15
46
Y
Typical section of North Tower

Figure 4b



Typical North Tower cross section

Figure 4c

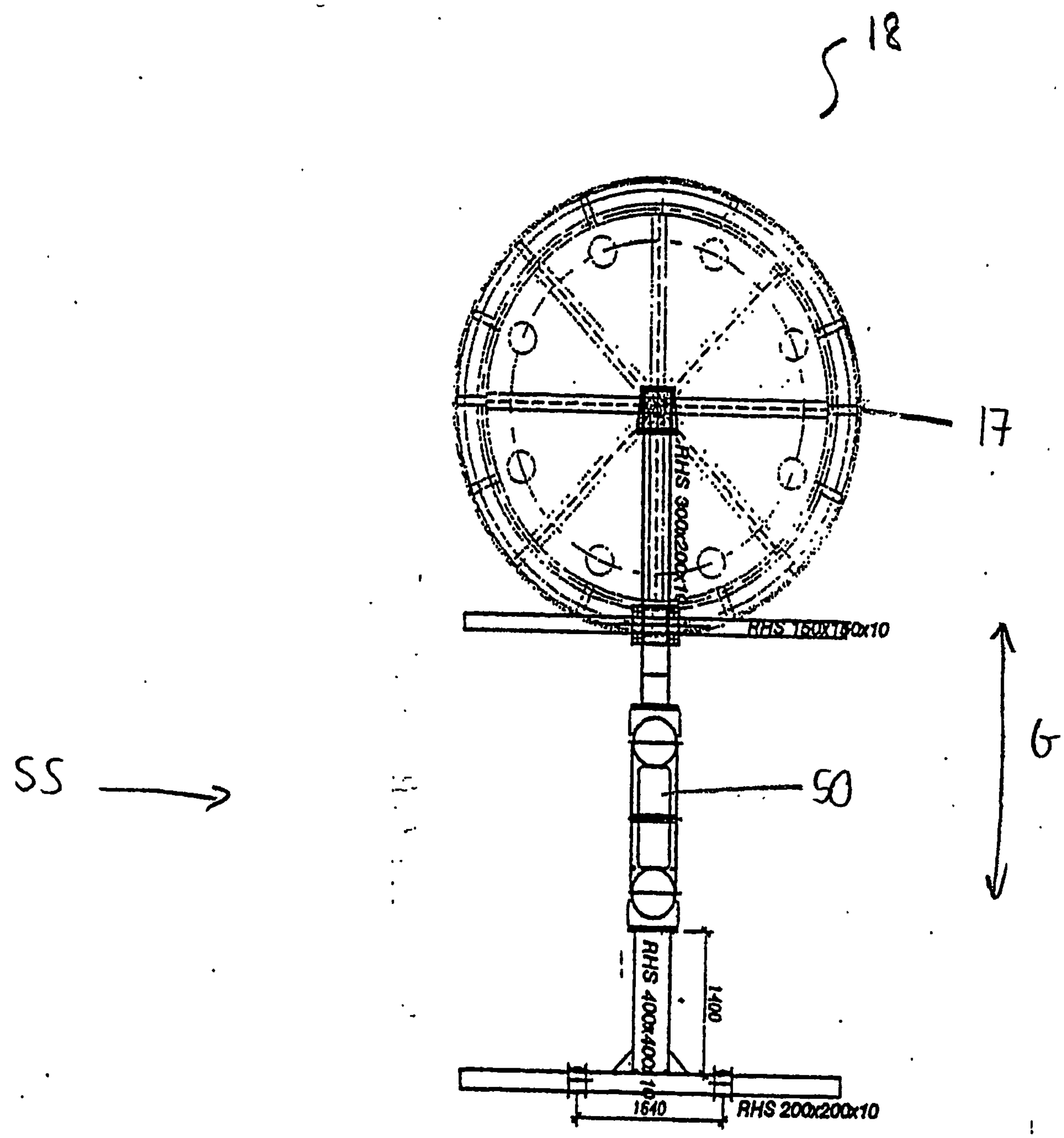
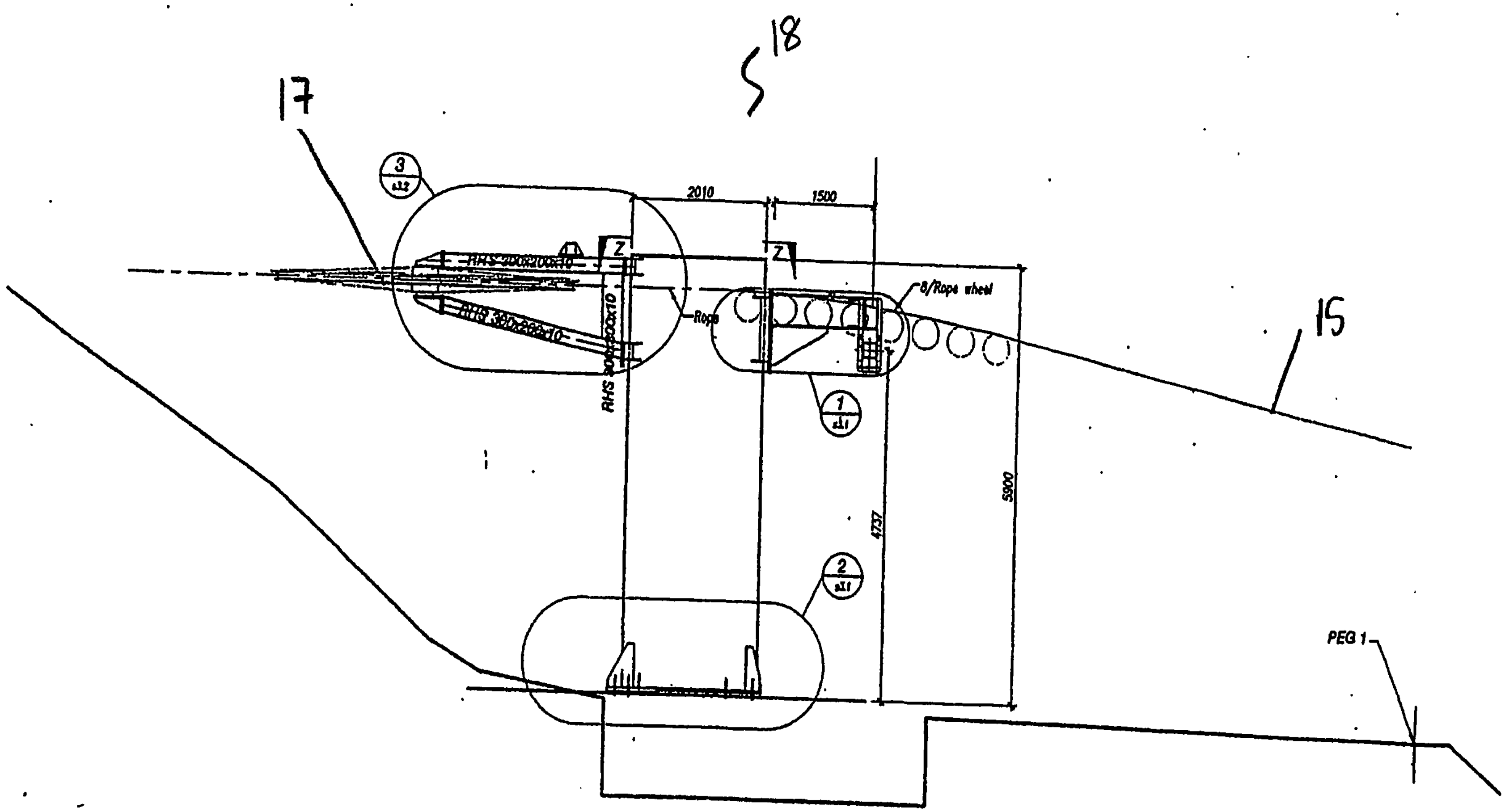

18
17
RHS 300x200x10
RHS 150x150x10
SS
50
G
1400
RHS 400x400x10
1640
RHS 200x200x10

Figure 5a



SECTION AT SOUTH END AT RETURN TOWER
SCALE = 1:50

Figure 5b